

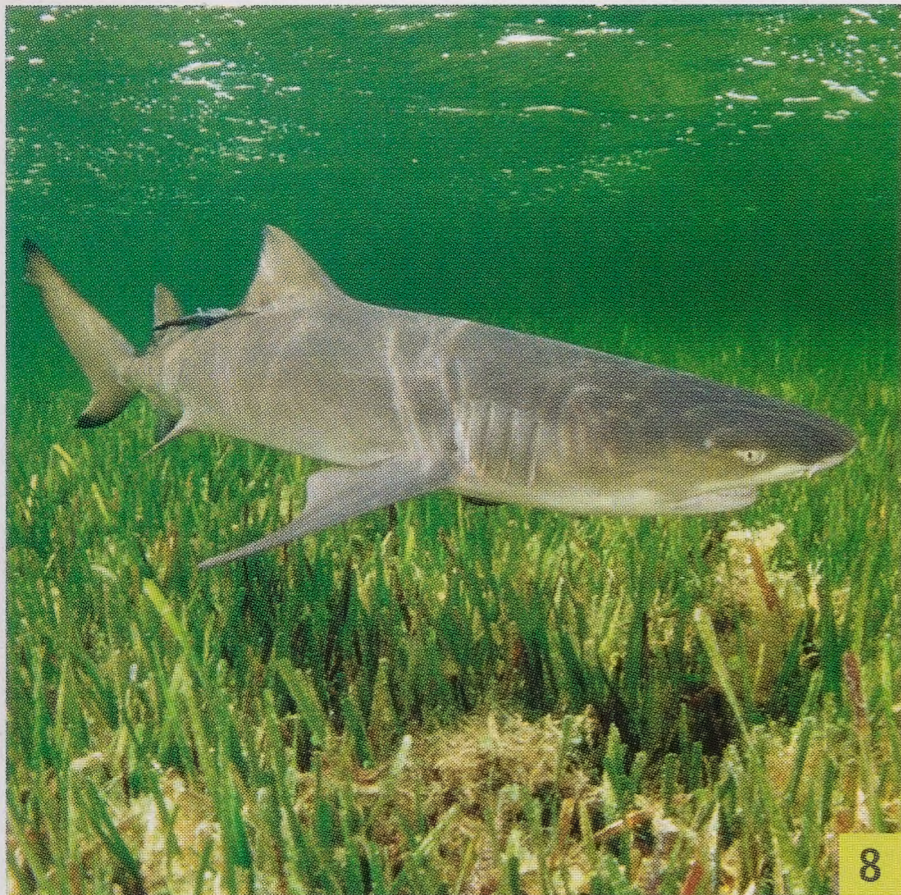
MARCH/APRIL 2006

Zoogoer

VOLUME 35, NUMBER 2







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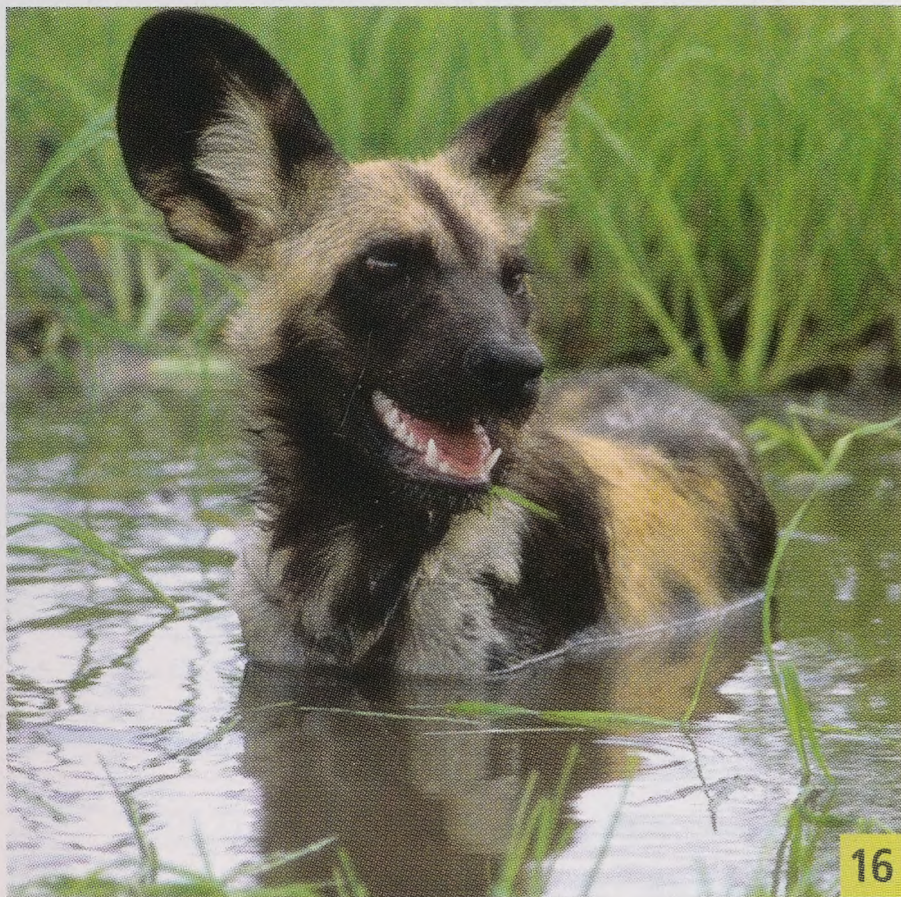
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FONZForum

Zoo Species Out of the Shadows

You may have noticed that Tai Shan has been in the spotlight since the day he was born last July—and rightfully so. As a result, the Smithsonian National Zoo's other animals have not so rightfully been in the shadows. The Zoo is full of marvelous animals that merit your attention when you next visit.

The cheetah cubs, four born in November 2004 and five born in April 2005, are now nearly full-grown and will soon leave for other zoos where they will have an opportunity to breed. (In fact, the elder cubs may be gone by the time you read this.) But watching the cubs and their mothers is spectacular, and I highly recommend you visit them before they disperse! One minute, five cheetahs are racing around their habitat, playfully chasing one another like oversize kittens. The next, they reveal their predatory nature: They stop and become preternaturally still, their muscles rippled with tension and eyes intently trained on potential prey, like the small parties of white-tailed deer that sometimes forage on the hill opposite their habitat. Or they switch from gamboling to slowly stalking some object we can't see but that has clearly awakened their hunting instincts. It is truly thrilling to watch.

The scimitar-horned oryx at the Cheetah Conservation Station provide a thrill of a different sort. These are beautiful African antelopes with a sad distinction: Their species is extinct in the wild, so you can see them only in a zoo.

Kandula, the Zoo's young male Asian elephant, also continues to delight. Kandula turned four years old in November, and now weighs more than 3,500 pounds and stands more than six feet tall. His favorite toy is a sturdy white plastic box that he pushes around, flips over and over, and stands on and rocks back and forth, practicing his balancing act. He also takes swings with his trunk at a hanging tire, exercising his growing muscles, including the tens of thousands in his trunk alone. If you haven't visited Kandula lately, you'll be amazed at how much he's grown.

At the Small Mammal House, check out one of Kandula's distant relatives—the rock hyrax—and prepare to be surprised. This is a little mammal, about the size of a small rabbit, that vaguely resembles a guinea pig but is most closely related to elephants and, of all things, manatees. Native to parts of sub-Saharan Africa, rock hyraxes are expert rock climbers, aided by rubbery pads on their feet that provide traction. While in the Small Mammal House, stop to visit the new banded mongooses and those perennial favorites, the naked mole-rats.

March 18, when we host our annual North American Wildlife Celebration, would be a great day to visit the Zoo. Special activities will highlight the Zoo's pinnipeds, Mexican wolves, American beavers, and river otters, all crowd pleasers, and you can learn about the challenges of conserving our continent's wildlife. You can also stop by to see prairie dogs in their renovated outdoor habitat and take a break while the kids explore the Prairie Dog Playland.

With the spring migration rapidly approaching, the Zoo is also a great place to bird-watch. More than 100 species, from belted kingfishers to eastern bluebirds, either pass through on the way to points north, stay to nest here, or are year-round residents. And, of course, the Bird House is always alive with the colors and calls of an array of birds, including recent arrivals such as a striking eclectus parrot, a species native to the South Pacific.

I've mentioned just a few of the Zoo's more than 400 species, each—large or small, mammal, bird, reptile, amphibian, or invertebrate—with its own intrinsic allure and story to tell if we take the time to listen. This is what is so special about your National Zoo, and about being a Friend of the National Zoo: a chance to explore the wildlife wonders of the world in all their diversity without venturing too far from home.

Sincerely,

James M. Schroeder

James M. Schroeder
Executive Director



is a nonprofit organization dedicated to supporting the conservation, education, and research efforts of the Smithsonian's National Zoo. Formed in 1958, FONZ was one of the first conservation organizations in the nation's capital. Friends of the National Zoo is dedicated to supporting the National Zoo in a joint mission to study, celebrate, and protect the diversity of animals and their habitats.

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Membership in FONZ offers many benefits: programs, publications, discounts on shopping and events, free parking, and invitations to special programs and activities to make zoogoing more enjoyable and educational. To join, write FONZ Membership, National Zoological Park, 3001 Connecticut Ave., N.W., Washington, D.C., 20008-2537, call 202.633.3034, or go to www.fonz.org.

Membership categories and annual tax-deductible dues are:

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Double	\$45
Individual	\$40
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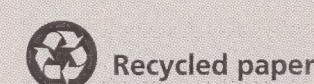
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On the cover: African wild dogs (*Lycaon pictus*) reinforce social bonds through play. Photo by Joe McDonald.



The Smithsonian's National Zoo is accredited by the American Zoo and Aquarium Association.

Letter from the Zoo Director



Caring and Commitment

As I write this, all of us at the National Zoo are mourning the loss of Toni, the female Asian elephant who was euthanized on January 25. Toni enjoyed a great life at the National Zoo for more than 17 years, and she died, as she lived, surrounded by the keepers, curators, and veterinarians who formed her extended family.

Toni, as we reported last summer, had debilitating arthritis resulting from a leg injury sustained before she arrived at the Smithsonian's National Zoo. Our expert veterinary staff worked hard to develop the best course of treatment for Toni, and consulted with colleagues nationwide seeking advice and collaboration in treating her.

Initially, Toni responded well to treatment, which included ibuprofen for its potent anti-inflammatory and pain-relief properties and glucosamine for supplementing her joints. However, during this time, Toni continued to lose weight, even though, with a good appetite, she was consuming more food than our other three elephants. The reason for her continued weight loss remains unclear.

In mid-January, veterinarians, keepers, and curators, some of whom have known Toni for nearly 17 years, advised me that Toni's periods of discomfort were becoming longer than her moments of happiness, and that there was nothing more we could do to reverse or cure her condition. After observing a continued and rapid decline, I sadly concluded, with staff concurrence, that it was the appropriate time to euthanize her. Through a complete pathological examination (which may be complete by the time you read this), we hope to learn more about what might have contributed to Toni's rapid decline.

As Director of the National Zoo, I must ensure that our animals receive the highest-quality care. I can say with confidence that Toni, a beloved member of our family, received care of the highest standard. Our keepers provided professional and careful attention and our veterinarians practiced expert medicine. Part of our responsibility is acknowledging when we have exhausted all options. In the end, euthanizing Toni was the last and most humane thing to do.

Before her death, there were calls to send Toni to a sanctuary. After careful consideration, I decided that this was not appropriate for Toni. The National Zoo staff was giving her the best of care and using a range of methods to treat her. In addition, Toni was simply too weak to endure such a trip. But more important, all who knew her agreed that Toni should be allowed to spend the remainder of her life in her home of 17 years, surrounded by the elephant family and Zoo keepers with whom she was comfortable.

Now, some groups are demanding that we send Ambika, Shanthi, and Kandula to a sanctuary. These three elephants are thriving at the National Zoo, and I am committed to continuing to provide them

a happy and healthy home. By now, I will have unveiled our plans for an expansive new state-of-the-art exhibit for Asian elephants in our urban Zoo, coupled with a habitat for Asian elephants at our Conservation and Research Center in Front Royal, Virginia. And here's why this is so important.

Asian elephants may very soon be extinct, both in the wild and in zoos. The National Zoo is determined to prevent this tragedy. We are developing a comprehensive breeding, education, and scientific research program to save these magnificent animals, to ensure that Asian elephants exist long into the future. We seek to preserve their power to amaze, inspire, and delight people who visit them in our Zoo, and to protect the natural Asian habitats on which both people and elephants depend.

Building new homes for Asian elephants at the Zoo is the cornerstone of our program to save Asian elephants. In addition to being places where our elephants live long, healthy lives while breeding to contribute to the survival of their species, they will offer our scientists, who have already amassed a huge body of knowledge about elephants, new opportunities to study elephants. Equally important, they will offer our millions of visitors the opportunity to see and marvel at these wondrous creatures, find out about what our scientists and others are doing to save them, and become inspired to join our efforts.

While all of us mourn the loss of Toni, we will celebrate her memory through our efforts to save her amazing species for future generations, through breeding Asian elephants at the Zoo, educating people about what they can do to help save them, and studying and conserving them in the wild. What a fitting memorial to this marvelous elephant.

Sincerely,

John Berry

Director

Smithsonian's National Zoological Park

P.S. To review our plans and learn more about our comprehensive program to save Asian elephants, go to www.fonz.org/elephants.htm.

Notes&News

Animal News

The Smithsonian National Zoo's four-year-old **Asian elephant** (*Elephas maximus*) Kandula keeps growing bigger and stronger. He weighed more than 3,500 pounds in January—about ten times more than he did at birth—and may weigh as much as 12,000 pounds as an adult.

John Rappole, a conservation biologist from the Smithsonian National Zoo's Conservation and Research Center, discovered a new species of bird in the temperate rainforests of sub-Himalayan Myanmar, where in the last decade a new species of deer, a new monkey, and several new species of reptiles and amphibians have also been found. Rappole and his colleagues published their findings on the new bird in the October 2005 issue of *The Auk*.

Rappole traveled to a remote area of northern Myanmar in 2004 to study the little-known bird life of the area with scientists from the University of Goettingen in Germany and the Myanmar Nature and Wildlife Conservation Division. The group found three birds with long bills that curved downward and long legs, toes, and nails. Based on these physical characteristics, the scientists deduced that the birds belonged to the genus *Jabouilleia*, and after careful study determined they were distinct from that genus' only other known living species, the **short-tailed scimitar-babbler** (*J. danjoui*) of Vietnam. They named the new species the **Naung Mung scimitar-babbler** (*J. naungmungensis*) after the village where they found it, and their discovery may help to encourage the conservation of biodiversity throughout Myanmar's rainforests.

Three male **Sumatran tigers** (*Panthera tigris sumatrae*) left the Zoo in January 2006 for their new home at Landry's Downtown Aquarium in Denver, Colorado. The cubs were born at the Zoo in May 2004, and by January 2006 had reached an age when young tigers typically assert their independence from their mothers. The brothers' move was recommended by the Species Survival Plan for Sumatran tigers, a cooperative breeding program among North American zoos. Their parents, female Soyono and male Rokan, will remain on exhibit at the Zoo and will likely breed again.



In 2005, Kandula gained 760 pounds. When he is about 15 years old, he will be full-grown and may weigh up to 12,000 pounds.

Volunteer Corner

by Molly Woods



Beaver Valley volunteers talk to visitors about sea lions and other North American species.

Ann Batdorf/NZP

Down in the Valley

The National Zoo is full of animals from far-off lands, but one area is devoted to species you might encounter closer to home—Beaver Valley. Exhibit interpreters in this area share information with visitors about wildlife and conservation in North America.

The focus on native species attracted interpreter Jill Gorski to the program. "It's one thing to know about a panda from China, but I had no idea what a beaver did." Now she's telling visitors what beavers do, as well as otters, wolves, sea lions, and a variety of other animals from our continent. She also talks about "backyard biology," or how what

we do in our own homes and neighborhoods affects wildlife and the environment.

Interpreters in Beaver Valley have plenty of objects and activities to share with visitors. Before an eagle feeding, for example, interpreters give visitors a close-up view of the raptors' food. They also explain the Valley's enrichment activities, such as the daily hiding of food around the otters' enclosure.

Valley interpreters volunteer April through November. If you're interested in joining the busy team in Beaver Valley, contact program supervisor Laura Klopfer at laurak@fonz.org or 202.633.1105.

Events

For more information on special celebrations at the National Zoo, visit www.fonz.org/events.htm.



Jessie Cohen/NZP

North American Wildlife Celebration

March 18*—10 a.m. to 4 p.m.

This event gives the whole family an opportunity to learn more about the Zoo's North American animals, local wildlife, and efforts to conserve

animals throughout North America. Free and open to the public.

**Please note that the date of this event has changed since the printing of the ZooGoer calendar.*

African American Family Celebration

April 17—10 a.m. to 4 p.m.

Washington-area families have come together to enjoy the day after Easter at the Zoo for more than 100 years. This year, FONZ invites you to a fun-filled day of multicultural activities for all ages. Free and open to the public.

Guppy Gala

May 12—6 to 8:30 p.m.

FONZ's wild party for children ages two to 12 features arts and crafts, live entertainment,

delicious treats, and fun activities. Proceeds support the National Zoo's conservation and education programs. Purchase tickets today at www.fonz.org/guppy.htm. Tickets are available online only. No phone or fax orders will be accepted.

ZooFari

May 18—6:30 to 10 p.m.

FONZ's annual epicurean extravaganza features more than 100 of the Washington, D.C., area's finest restaurants and vintners from around the country. Gourmet foods, fine wines, and fabulous entertainment make ZooFari the talk of the town. Purchase tickets today at www.fonz.org/zoofari.htm. Tickets are available online only. No phone or fax orders will be accepted.

Lectures

All lectures at the National Zoo are free and open to the public. For more information or to RSVP, please visit www.fonz.org/lectures.htm.

Tigers of the Emerald Forest

March 16—Film screening at 7:30 p.m.

Scientists Raghu Chundawat and Joanna Van Gruisen reveal the secrets of the Emerald Forest's tigers in this engaging film, with an introduction from John Seidensticker, a National Zoo senior scientist and a tiger specialist. This program is in cooperation with the D.C. Environmental Film Festival.



www.photos.com

The Future of the Wild

April 6—Book signing at 7 p.m., lecture at 7:30 p.m.

Jonathan Adams is a conservation biologist and a program director of conservation knowledge and communities with The Nature Conservancy. In *The Future of the Wild*, Adams uses stories about grizzly bears, pumas, wolves, and more to propose a new conservation program for America that will allow wildlife and wild lands to flourish in the midst of a growing

human population. He will sign copies of his book and talk about his inspiring and hopeful vision.

The Weather Makers

March 22—Book signing at 7 p.m., lecture at 7:30 p.m.

Tim Flannery is director of the South Australian Museum, professor at the University of Adelaide, and an internationally acclaimed scientist, explorer, conservationist, and writer. He will talk about the history of global climate change, the danger it poses to our planet, and constructive solutions to averting its catastrophic effects, as well as sign copies of his book, *The Weather Makers*.

Painting Birds

April 20—Book signing at 7 p.m., lecture at 7:30 p.m.

Ever wondered how an artist gathers inspiration for a painting, and transforms it from its first sketches to its final wash? Or how artists make a living drawing and painting natural history subjects? Widely published artist Julie Zickefoose, who

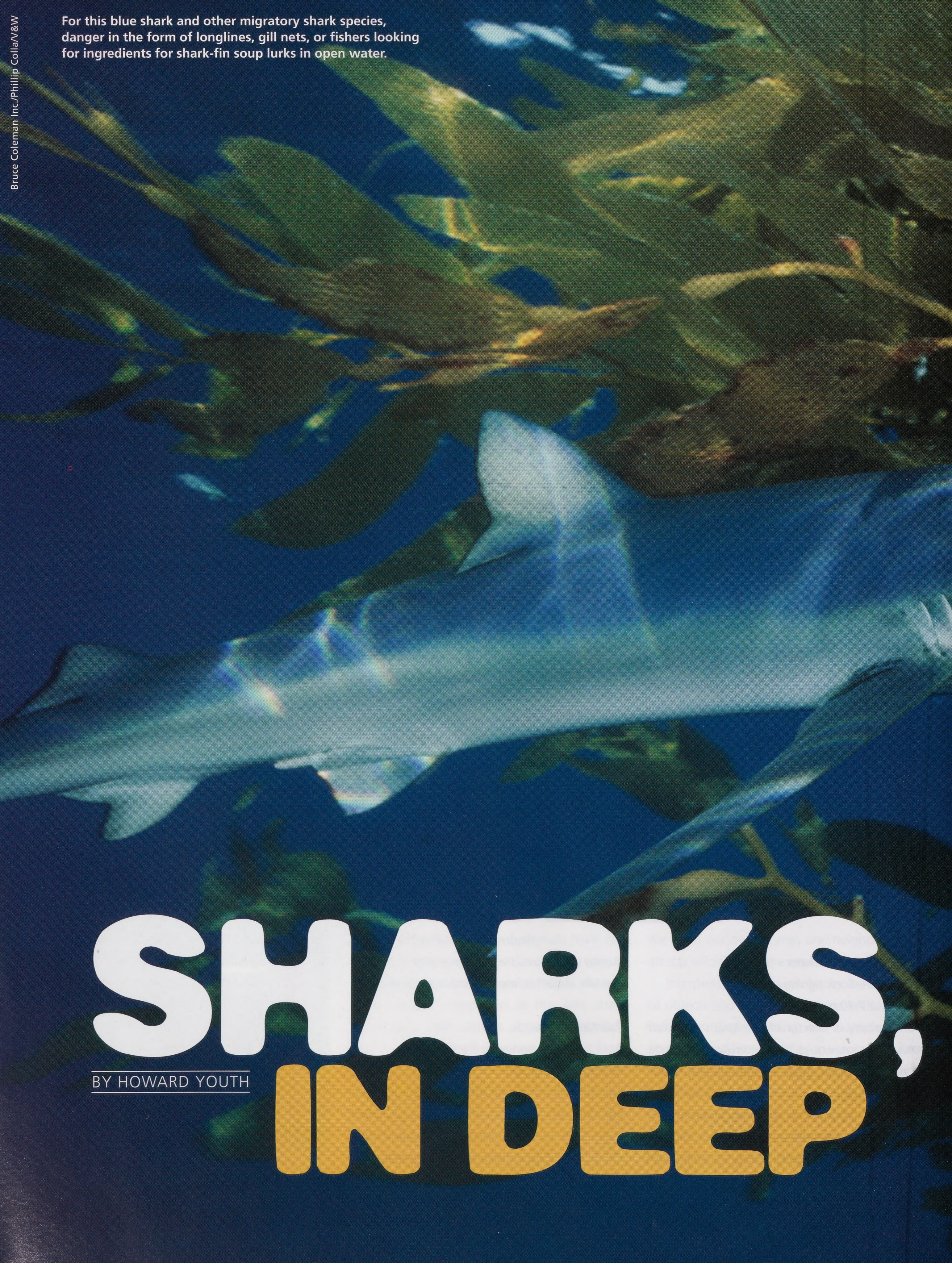
specializes in birds, opens her sketchbooks, studio, and gallery for a walk-through in this slide talk. She will also sign copies of her books before the lecture, which is part of the Zoo's celebration of International Migratory Bird Day.

Chivalry Is Dead in Migratory Birds

May 4—Lecture at 7:30 p.m.

There's a battle of the sexes raging in the tropics, where male migratory birds compete with females for the best habitats—and usually win. As a result, females suffer lower survival rates. Peter Marra of the Smithsonian Migratory Bird Center will talk about this and other discoveries from his 15-year research program on the winter ecology of migratory birds in Jamaica. This lecture is part of the Zoo's celebration of International Migratory Bird Day.

Correction: The "Living Light" story in the January/February 2006 issue of ZooGoer stated that Charles Darwin saw a milky white sea, which was likely caused by bioluminescent bacteria, in 1933. In fact, this took place in 1833. ZooGoer regrets the error.



For this blue shark and other migratory shark species, danger in the form of longlines, gill nets, or fishers looking for ingredients for shark-fin soup lurks in open water.

SHARKS, BY HOWARD YOUTH IN DEEP

Bruce Coleman Inc./Phillip Colla/V&W



Shoulder-deep in salt water, with chest, hips, knees, and toes completely out of view, who hasn't seriously pondered what lurks beneath the frothy green waves? Marine biologists certainly do—not out of fear, but because so little is known about sharks and because many of these oceanic predators are disappearing in a watery realm now dominated by humans.

Thirty years after their appearance, the popular novel and film *Jaws* and dramatic "shockumen-

taries" depicting feeding frenzies still loom large in the public's outlook on sharks. But not everyone views these fish as monsters, including the people who know them best. "The perception has been that sharks bite, bite, bite, that they're mindless feeding machines. You might say humans are the same around the Thanksgiving table," says A. Peter Klimley, a University of California, Davis, marine biologist who has spent much of the last 25 years studying shark migration and behavior.

Yes, sharks do kill a few people each year. But unprovoked shark attacks, while alarming and grisly, are rare compared with other perils. Of the world's approximately 500 shark species, four—tiger (*Galeocerdo cuvier*), bull (*Carcharhinus leucas*), oceanic whitetip (*C. longimanus*), and white (*Carcharodon carcharias*)—rack up the lion's share of attacks on humans. Shark researchers try to put attack statistics in context: During the 1990s, an annual average of 130 U.S. motorists died after colliding with deer, while an average of 15 people succumbed to venomous snake bites, according to the International Shark Attack File kept at the Florida Museum of Natural History in Gainesville. During the same time period, the annual average number of people killed by sharks in U.S. waters was 0.4.

In 2004, 61 unprovoked shark attacks were documented around the world, including seven fatal incidents. Compare these figures with the estimated 100 to 200 million sharks killed by commercial and sport fishing each year, and it's clear that humanity poses a widespread risk to sharks rather than the other way around.

Shark Basics

The popular image of sharks as dolphin-size, gray, and torpedo-shaped is accurate for some species, but not nearly all. In size, sharks range from the banana-size dwarf lanternshark (*Etmopterus perryi*) to the world's largest fish, the whale shark (*Rhincodon typus*), which reaches lengths of 40 to 50 feet. Sharks range in build from thin to squat and in color from bright blue to zebra-striped. And while all sharks are predators, what they eat and how they procure it varies greatly. Some haunt tropical reefs and snap up small fish; others grab seals in cold waters. Angelsharks (genus *Squatina*) lie camouflaged on the ocean floor, then ambush passing mollusks and fish. Small cookie-cutters (genus *Isistius*) wander the open water, taking bites out of larger sharks and other fish. The huge whale shark sucks in a large volume of water then strains it through its gill slits, leaving behind a hearty serving of plankton, wriggling fish, or crustaceans.

While sharks are fish, they belong to a different class (Chondrichthyes) than

the world's 25,000-plus bony fish species (Osteichthyes). The two classes likely diverged as far back as 400 million years ago. Among other differences, sharks and the closely related rays, skates, and chimaeras lack plate-like bony scales and have skeletons comprised of cartilage, not bone. Also, sharks have five to seven pairs of gill slits, while bony fish have one pair of gill openings.

There are differences you can't see from the outside too. For ex-

ample, sharks lack the swim bladder that keeps bony fish suspended in the water. Instead, they are kept from sinking or floating by their cartilaginous skeletons, which are lighter than bone, and by oil stored in their livers that is lighter than water. Shark species that migrate across open water also maintain neutral buoyancy—and extract oxygen from the water—by remaining in constant motion.

Sharks have relatively large brains in proportion to their body size and highly developed senses. Keen senses of smell and taste, for example, help sharks locate both prey and mates. And they alone have jelly-filled organs in their heads called ampullae of Lorenzini, which are electro-sensory receptors that may help sharks locate prey hidden in sand and under other cover or detect changes in water temperature. Migrating sharks may also use their ampullae to navigate by orienting themselves via the Earth's magnetic field.

Some sharks lay eggs, while others bear live young that feed on undeveloped eggs or siblings in the womb,

or are nourished by a placenta similar to that of mammals. Either way, sharks produce far fewer young and take much longer to mature than many commercially valuable bony fish. The sandtiger shark (*Carcharias taurus*), for example, bears just two pups born after a gestation that lasts nine to 12 months, while a large female striped bass (*Morone saxatilis*) produces about 4.2 million eggs, and a female southern bluefin tuna (*Thunnus maccoyii*) releases about 15 million eggs over several days. Some small shark species start breeding when they are a few years old and may produce more young than sandtigers, but most large coastal shark species, including the notorious white shark, bear only between



Contrary to popular stereotypes, white sharks are not insatiable man-eaters. They target fatty prey, such as seals and sea lions, rather than humans.

It's clear that humanity poses a widespread risk to sharks rather than the other way around.

Bruce Coleman Inc./Brandon D. Cole/V&W



Bruce Coleman Inc./Alex Kerstitch

An opened egg case reveals a developing swell shark (*Cephaloscyllium ventriosum*) embryo connected to a nourishing yolk. Swell sharks may remain in their egg cases for up to 12 months; the temperature of the surrounding water affects the timing of their emergence.

two and 12 pups. Females of most of these large species don't reach maturity until they are between ten and 17 years old. Some, like the dusky shark (*Carcharhinus obscurus*) and the white, breed only every two or three years.

In the natural scheme of things, slow shark reproduction works fine. While sharks produce far fewer offspring and take longer to mature than bony fish, many are relatively long-lived (dusky sharks, for example, may live 40 years or longer) and their pups are relatively large, standing a better chance against predators than do tiny bony fish eggs and fry. But when people are thrown into the mix, sharks often don't fare so well; many species simply can't breed fast enough to keep up with the relentless pace of today's fishing industry.

Troubled Waters

As shark populations slip downward, our knowledge of how they live and how best to protect them remains, in many cases, sketchy. "Part of the reason we know so little about sharks is that they used to be considered nuisance species," says Enric Cortes, a research fishery biologist with the National Marine Fisheries Service in Panama City, Florida. Cortes and his colleagues work to assess shark populations in U.S. waters of the Atlantic, Gulf of Mexico, and Caribbean. It's a tricky business given vast areas of sea, huge fishing fleets, and fishing boats' often spotty reporting of which and how many sharks they catch, either intentionally or as bycatch.

Sharks produce far fewer young and take much longer to mature than many commercially valuable bony fish.

Although public concern about terrestrial endangered species, freshwater pollution, pesticides, and other environmental issues grew to a frenzied pitch during the 1960s, '70s, and '80s, only shark biologists seemed to fret over sharks, and they had minimal support. "There was little or no funding for research," says Cortes, looking back. "We're still suffering from that."

Even the total number of shark species remains hazy, as new species continue to come to light. Fifteen years ago, many experts claimed there were about 350 shark species worldwide, but today, about 460 species is a more common estimate. Marine biologists believe the total may rise to about 500 when poorly known—as yet not formally described—species are included.

The total might also decrease, as more and more shark species experience population declines. The World Conservation Union lists six shark species as critically endangered; four as endangered; 24, including the sandtiger and white shark, as vulnerable; and 59 others as near-threatened. An additional 107 species fall within the murky data-deficient category, meaning there is inadequate information to assess their risk level.

One thing is certain: The fishing industry threatens the ability of many shark populations to sustain themselves. Thanks to better ocean mapping, sonar, and bigger, faster boats, the world's fisheries are more accessible than ever before. The tools boats use to catch fish are also far larger in scale. One open-ocean longline, for example,



Bruce Coleman Inc./Philip Colla/V&W

Scientists do not know why scalloped hammerheads congregate in schools. In some cases, juveniles swim at the school's core while adults patrol its perimeter, perhaps to protect the vulnerable young from predators. Adult hammerheads may also school to socialize or find mates.

may stretch 80 miles and have thousands of hooks that grapple fish, birds, turtles, and any other sea creatures that take the bait.

Many sharks are caught intentionally, but just as many fall prey to the wasteful practices of large fishing fleets. Scientists estimate that about half of the 100 to 200 million sharks killed each year are by-catch, caught unintentionally in nets or on hooks set for tuna, shrimp, and other sea life.

A shark's chance of surviving being hauled onto a boat often rests in the hands of fishers, who have to process the hooks or nets quickly. In the U.S., says Cortes, sharks caught as by-catch on lines are sometimes kept by fishers, "but usually they cut them off the line with the hook attached. These sharks may do well or not." In some species, sharks frequently die before they are hauled aboard, perhaps because of stress. Hammerheads (genus *Sphyrnidae*) and other species that must swim continuously to extract oxygen from the water also tend to die quickly, because the flow of water over their gills is restricted when they are tangled in nets.

Despite sharks' vulnerability to overfishing, "most shark fisheries around the world are virtually unmonitored and completely unmanaged," write shark experts Leonard Compagno and Sarah Fowler in their 2005 book *Sharks of the World*.

Reaching for Limits

The decline of Canada's porbeagle shark (*Lamna nasus*) population sheds light on the dangers of no-holds-barred fishing. Porbeagles were heavily fished off the Atlantic coast of Canada for decades; because female porbeagles do not reach maturity until they are 13 years old and then typically bear just four young each year, the porbeagle population could not sustain heavy fishing. The Canadian government declared its Atlantic porbeagle population endangered in 2004 after a study revealed a 90 percent drop in the porbeagle population since the 1960s. Catch quotas were lowered and breeding grounds closed off.

Porbeagles are not the only species suffering in the North Atlantic. In a 2003 paper in the journal *Science*, Dalhousie University biologists Julia K. Baum, Ransom A. Myers, and their colleagues reported "rapid large declines in large coastal and oceanic shark populations" in

Fishing quotas and bans on scarce species in eastern U.S. waters may be helping some sharks recover somewhat, but not enough.

the heavily fished northwestern Atlantic. They estimated that white, scalloped hammerhead (*Sphyrna lewini*), and thresher sharks (genus *Alopias*) declined by more than 75 percent in the previous 15 years. "Only in the past half century, as fishing fleets expanded rapidly in the open ocean, have large marine predators been subject to this intense exploitation," they wrote.

Since the 1990s, the United States has been one of the few countries trying seriously to manage its shark fisheries. Fishing quotas and bans on scarce species in eastern U.S. waters may be helping some sharks recover somewhat, but not enough. According to Cortes, a regional assessment of large coastal sharks in the Atlantic and the Gulf of Mexico in 2002 “indicated that the biomass hasn’t reached a sustainable level—essentially that there is overfishing.” But before a U.S. shark fisheries management plan and ban on shark finning—lopping off fins and tossing the rest of the sharks overboard—in the 1990s, the situation was worse. “What drove the declines occurred mostly in the late 1970s and 1980s, although sharks are still not to their pre-exploitation levels,” says Cortes.

Beyond coastal purview, sharks swim the dangerous gauntlet of the global commons. Wide-ranging blue sharks (*Prionace glauca*), for example, constantly cross boundaries and oceanic expanses, migrating seasonally or following currents to reach areas of greatest prey abundance. Blue sharks also segregate by sex and age, with mature males and females meeting only briefly to mate. Understanding this species’ complex life history is critical for setting sound shark-fishing guidelines. Yet even if strict guidelines were drawn up, it would be hard to gauge their success given that no one really knows how many blue sharks are caught in most areas. “There is a lot of uncertainty about the levels of landings and bycatch. ...We have much more work to do,” says Cortes.

Finning is a wasteful practice that has been hard to monitor on the high seas. Fins are prized in Asia for use in shark-fin soup, a delicacy that can fetch \$100 or more a bowl in increasingly affluent regions of that continent. After more than a decade of outcry by conservationists, the first international ban on shark finning—effective only in the Atlantic—was adopted in 2004 by more than 60 member nations of the International Commission for the Conservation of Atlantic Tunas. The United States, Brazil, Canada, the European Union, Namibia, and South Africa have also enacted finning bans in their own waters.

Fins are prized in Asia for use in shark-fin soup, a delicacy that can fetch \$100 or more a bowl in increasingly affluent regions of that continent.

In 1999, the Food and Agriculture Organization of the United Nations instituted an International Plan of Action for shark conservation, but few of the countries that signed on have crafted the requested national plans to monitor and control their shark fisheries, the United States being one rare exception. While awareness of the need to conserve sharks is growing worldwide, the determination to stem their decline is not keeping pace. Already, there are signs that the seas are suffering as a result.

Bites Out of the Food Chain

Marine biologists are now convinced that what they feared might happen over the last 20 years has come to pass: The widespread capture of sharks for fins and meat and as bycatch is changing ocean ecology. A study by Myers and researcher Peter Ward published in

the April 2005 issue of the journal *Ecology* found that in the tropical Pacific Ocean between Hawaii and Fiji, larger sharks, along with other top predators such as tuna and marlin, are being replaced by smaller fish species such as pelagic stingrays. According to Myers, “the main consequence of many years of industrial fishing in the area is a reordering of the ecosystem, thus increasing the number of small fish that we don’t like to eat.” The size of sharks still being caught in the region has dropped dramatically: In the 1950s, blue sharks caught there averaged 115 pounds, while those caught in 2000 weighed on average 49 pounds. During that same time period, catches of blue sharks dropped more than 85 percent.

“When you chop off the top of the food chain, you get a lot of

destabilization of the system,” says Samuel Gruber, a professor of marine and atmospheric science at the University of Miami and director of the Bimini Biological Field Station in the Bahamas. “Certain fish that sharks normally keep down are then free to eat other fish that keep algae down on the reefs, and so on.” The loss of algae-grazing fish may leave reefs vulnerable to the rapid



Fins from sharks caught in the Gulf of California dry on shore.

Bruce Coleman Inc./Alex Kerstitch

expansion of competing algae, which may slow the coral’s development or overtake the ecosystem.

Gruber, who has studied lemon sharks (*Negaprion brevirostris*) at a nursery at Bimini, has watched their numbers dwindle over the past 20 years. “We went from catching ten sharks per 100 hooks every 24 hours—to be tagged and released—to just less than one per 100 hooks. This is happening on a global basis,” says Gruber. “They’re just running sharks into oblivion. It’s no longer survival of the fittest because nobody’s as fit as humans.”

Discovering Sharks

Beneath the water’s glassy surface lie many unanswered questions about the basic life history and distribution of sharks, but the last few decades have yielded exciting discoveries. One of the biggest catches of the late 20th century occurred off Hawaii in 1976, when a 14-foot-long, soft-skinned shark with a melon-like head got snagged on the anchor of a U.S. Navy vessel. Dubbed “megamouth,” this shark was formally named *Megachasma pelagios*, which means “great sea cavern” in Greek, in 1983. The megamouth was so dissimilar to other known sharks that scientists created a new genus and family for it. To date, megamouths have been sighted 27 times, with reports scattered across the Pacific, Atlantic, and Indian oceans. One was tagged and tracked in open water. It was recorded at 45 feet below the surface at night, then dove down to 450 feet below the surface during the day, likely following the plankton it feeds on.

Megamouths and many other sharks do not limit their movements to vertical jaunts in the water column—some also migrate great distances. Just how far they travel is now coming to light, thanks to satellite tracking and other research efforts. In October 2005, a study published in *Science* documented dozens of salmon sharks (*Lamna ditropis*) migrating from summering areas in Alaska to wintering spots off Hawaii and Baja California, Mexico. Many other species are known to migrate, including the whale shark. One was charted traveling 8,000 miles in one direction over three years.

The longest journey detected to date was the trek taken by a female white shark that swam 12,400 miles, from near South Africa to Australia and back, in under nine months. This discovery marks the first concrete evidence that South African and Australian white shark populations are not isolated from one another.

“Finding that they make long-distance movements, that’s interesting,” says Klimley. “But why [do they do it]? That’s what I’d like to know.” Klimley and others have studied white sharks for years and thanks to their work, this species is one of the best understood. But that doesn’t mean it’s fully understood. “Nobody knows how many white sharks there are per area. That’s important for protection interest. Do they arrive in groups? Do they depart in groups? How often do they feed? How extensive are their movements? That’s what we want to find out.”

The answers may take years to find. Gruber, for example, spent 30 years studying juvenile lemon sharks in their shallow lagoon nursery habitat, but wanted to find out how and where the adults bred. Then, in 2005, he and his colleagues began studying a large group of adult lemon sharks in the waters off Jupiter, Florida. Gruber now thinks they finally understand how adult lemon sharks get together to breed—females return to their birth areas and release pheromones into the current. The pheromones attract nomadic males. He thinks other shark species could have a similar game plan, but that remains to be seen.

Cold Water, Warm Sharks

Perhaps no shark species has stirred more public emotion, and been more misunderstood, than the white shark, which is the villain of Peter Benchley’s novel *Jaws*. In light of recent studies, Benchley acknowledges that his past writings painted a less-than-accurate picture of the white shark in action. In his 2002 nonfiction book *Shark Trouble*, Benchley writes:

The new knowledge we’ve gained since the mid-1970s has convinced me that while almost all of the great-white-shark behaviors I described in Jaws do, in fact, happen in real life, almost none of them happen for the reasons I described. ... We knew so little back then, and have learned so much since, that I couldn’t possibly write the same story today.

A lemon shark in Key Largo, Florida.



Bruce Coleman Inc./Masa Ushioda/V&W



Bruce Coleman Inc./Brandon D. Cole/V&W

A white shark rockets out of the water, using violent force and the element of surprise to capture a seal decoy. This predatory technique, called breaching, is effective for hunting nimble and fast-swimming prey, but is energetically costly for the shark.

These days, white sharks' behavior in general and feeding habits in particular are less of a mystery, thanks to scientists like Klimley, who has spent countless hours watching white sharks hunt seals and sea lions. "They investigate almost anything at the surface. They can't see well," he says. "They get close enough to see, and make a decision if they're going to eat." Klimley and others believe that white sharks often take sample bites and will quickly abandon food with low fat content, as they typically do with birds and humans.

Immature white sharks have different feeding preferences than mature white sharks, which fascinates Klimley. "The little ones seem to hang out in warm water and feed on fish, which is a low-energy food, while big ones live in cold water and eat marine mammals—high-energy food. They're almost like different species," he says.

Klimley believes that a high-fat diet of flabby sea mammals enables white sharks to live in cold waters where many other sharks don't venture. "Why should a white shark be a picky feeder, and why show a preference for fatty prey?" writes Klimley in his 2003 book *The Secret Life of Sharks*. "The answer may be that surplus energy is needed to keep the shark's body warm." Klimley once touched an adult white shark as it swam past his boat. "Its body was warm, around 75 degrees F in contrast to the cold water, often in the 50-degree range off Northern California," he writes, adding that "the

White sharks often take sample bites and will quickly abandon food with low fat content, as they typically do with birds and humans.

white shark derives thermal energy from the same insulating fat that enables seals to survive and thrive in cold waters."

Some sharks frequent even chillier coastal waters than those favored by white sharks. Off Alaska, salmon sharks—stout, speckle-bellied fish in the same family as white sharks—maintain a constant core temperature of around 79°F, which is 36 degrees higher than the surrounding water. Salmon fishers consider them competitors, and off parts of Alaska the sharks' distribution closely matches key salmon concentrations. Both salmon sharks and Pacific sleeper sharks (*Somniosus pacificus*) increased dramatically in Alaskan waters during the 1990s, for reasons that keep scientists scratching their heads.

Why are salmon and sleeper sharks on the rise off Alaska? Did more sharks move to the area due to water temperature changes or changes in prey distribution, or both? Or is there a general increase in their populations? These are but a few of the questions still circling around sharks and their ecosystems.

While we may continue to fear them for what they are—supremely adapted predators—we are also learning to appreciate sharks. For life without them means oceans with a lot less bounty, and a lot less mystery. Z

—Contributing editor Howard Youth's recent ZooGoer articles explored border parks, eastern coyotes, Florida's exotic reptiles, and Spain's Canary Islands.

The Painted Wolves OF ZULULAND

BY MICAELA SZYKMAN



A pair of African wild dogs keeps vigil at dusk. African wild dogs, also called painted wolves, are among Africa's most endangered carnivores, and scientists from the Smithsonian's National Zoo are helping to reintroduce them to the KwaZulu-Natal province of South Africa.

It's 4 a.m. and dawn is breaking on a summer's day in South Africa. As the sun rises over Hluhluwe-iMfolozi Park, I watch a pack of African wild dogs awaken and begin their elaborate morning ritual. A few dogs greet each other, running side by side in submissive postures with their ears back, heads

down, and bodies crouched. They lick each other's mouths and express their excitement with remarkably undoglike twitters, chitters, and whines. Other pack members join in, and even adults engage in playful behavior. Soon, the whole Hluhluwe Pack is up and running around.





Micaela Szykman

A yearling female named Khanda keeps watch over a litter of her younger siblings while the rest of the pack hunts. Cooperative pup-rearing and hunting are integral to a pack's survival.

Sometimes I drive an hour over rough and winding park roads to catch these important morning activities, which many scientists believe hold the pack together by reinforcing social bonds and fostering cooperation between members. If the dogs are at their den, I know where to find them. If not, I locate them with the help of signals from radiocollars worn by one or two pack members. But the effort is worth it and I feel privileged to have the opportunity to watch these fascinating animals play, hunt, feed, and rest.

African wild dogs are as beautiful as their scientific name—*Lycaon pictus*, which means “painted wolf” in Latin—suggests. Their coats are a stunning patchwork of white, yellow-brown, and black fur. They are lean and tall compared to coyotes, standing up to 30 inches high at the shoulder and weighing between 40 and 60 pounds, with outsize, saucer-shaped ears.

Their common name can be misleading, however. For some, the term “wild dog” implies a gang of runaway domestic dogs (*Canis lupus familiaris*)

that roam around in a menacing pack. But African wild dogs are only remotely related to domestic dogs, and have never been domesticated. Wild members of the canid family that are called “wild dogs” live on every continent except Antarctica: African wild dogs in Africa, wolves (*Canis lupus*) in North America and Europe, bush dogs (*Speothos venaticus*) in South America, dholes (*Cuon alpinus*) in Asia, and dingoes (*Canis lupus dingo*) in Australia.

African wild dog populations began a decline a century ago that has accelerated over the last 30 years. Habitat fragmentation, persecution and hunting by humans, diminishing prey populations, and diseases transmitted by domestic dogs, including rabies, distemper, and parvo virus, are the main causes of the decline. Competition with other carnivores such as lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) and collisions with vehicles also diminish wild dog numbers. Although they formerly ranged across sub-Saharan Africa, African wild dogs have disappeared from 25 of the 39 countries they once occupied, and survive only in scattered populations, mostly in eastern and southern Africa. Fewer than 5,000 individuals remain on

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the continent, which makes them far rarer than several high-profile endangered species. By contrast, between 9,000 and 12,000 cheetahs (*Acinonyx jubatus*) and between 100,000 and 130,000 African elephants (*Loxodonta africana*) live in the wild in Africa.

Wild dogs are among the most challenging carnivores to conserve, but it is not too late to prevent their extinction. I arrived in South Africa in 2003 to coordinate the African Wild Dog Reintroduction and Conservation Program, a science-based project initiated by the Smithsonian's National Zoo in partnership with other American and South African research institutions. Our work will contribute to the efficient design and implementation of future wild dog reintroductions and, we hope, the survival of the species.

Losing and Regaining Ground

African wild dogs' population decline began in the early 1900s, when misconceptions about the species bred widespread fear and hatred of the dogs. For much of the 20th century, some wildlife managers considered the dogs savage killers that threatened

the survival of other species, and shot them on sight, as did farmers and ranchers who believed the dogs took their livestock. Although African wild dogs do occasionally prey on livestock, they prefer wild prey such as impala (*Aepyceros melampus*) when it is available. Wild dogs catch a variety of prey species ranging from small animals such as lizards or hares to large mammals such as blue wildebeest (*Connochaetes taurinus*).

Field studies in the 1970s gave scientists a better understanding of wild dog ecology, behavior, and population decline, and by the 1980s, the species was legally protected in six countries. One of these was South Africa, where the only viable population of wild dogs lived in Kruger National Park in the northeast. Attempts were made in the 1980s to reintroduce wild dogs to the KwaZulu-Natal province south of Kruger, where wild dogs had not been seen since before the 1920s. But these reintroductions were only moderately successful because the captive-bred dogs struggled to learn how to hunt for themselves and evade predators such as lions.

In 1997, recognizing the need for action to prevent wild dogs' extinction, members of the Canid Specialist Group—a subgroup of the World Conservation Union's Species Survival Commission—conducted a Population and Habitat Viability Assessment for African Wild Dogs, and subsequently published the African Wild Dog Status Survey and Action Plan. The group found that the wild dogs' future looked grim, even within park boundaries. "Over half the wild dogs found dead in protected areas have been shot, snared, poisoned, killed by road traffic, or infected with diseases by domestic dogs outside the reserve," according to the plan, which also identified habitat fragmentation as a leading cause of wild dog population declines.

For much of the 20th century, some wildlife managers considered the dogs savage killers that threatened the survival of other species, and shot them on sight.

Despite the many threats that African wild dogs face, the plan aimed to protect and even enlarge existing wildlife areas that support wild dog populations, as well as to re-establish populations that had been extirpated from protected areas. It also identified southern Africa as the place that "holds wild dogs' best hope for the future."

Kruger National Park has a viable population of between 150 and 250 wild dogs, and Hluhluwe-iMfolozi Park in KwaZulu-Natal was identified as a suitable area to establish a second substantial population in South Africa. Following the minor success of the 1980s reintroductions, more recent reintroductions in 1997, 2001, 2002, and 2003, along with natural pack formations within the reserve in the past year, have substantially increased Hluhluwe-iMfolozi's wild dog population to more than 45 adults and yearlings and many new pups born in 2005. There is currently a record-breaking number of five breeding packs in the park, including the Hluhluwe Pack that I watch on early summer mornings.

A Close-knit Family

Working in KwaZulu-Natal, I see first-hand the challenges of conserving African wild dogs.

Because pack members cooperatively hunt, raise pups, and defend themselves against predators in order to survive, we must maintain large populations containing several intact packs and give dispersing dogs opportunities to create new packs. And wild dogs require vast areas of habitat: Packs may range up to 350 square miles if they have no pups younger than three months old. But as humans carve

that habitat into smaller and more scattered fragments, packs and dispersing dogs are becoming more isolated from one another and are at greater risk of exposure to intolerant farmers, collisions with vehicles, and domestic dogs.

The Hluhluwe Pack's morning ritual reveals the intensely social nature of African wild dogs. Packs constantly reinforce social bonds through friendly interactions and play, and move as a single, cohesive unit, hunting, feeding, playing, resting,



African wild dogs chase down a blue wildebeest.

Bruce Davidson/www.naturepl.com



and even raising pups together. Most packs are led by a dominant, or “alpha,” female that is the mother of all the pups and a dominant male that fathers most, if not all, of the pups. But every pack member, including yearlings, helps care for the alpha pair’s offspring. When the pack goes out to hunt, the dominant female or a babysitter female stays behind with pups younger than three months old to protect them from predators. After the pack has hunted and fed, it returns to the den, where the adults regurgitate a helping of partially digested food from the morning’s kill for the pups. This communal social system is called cooperative breeding, and it enables wild

dogs to have relatively large litters: On average, they give birth to eight or nine pups and may have litters as large as 20 pups.

Although some packs are formed by a lone pair, most are composed of between ten and 30 adults and yearlings, and studies indicate that packs with fewer than four adults experience greater pup mortality than packs with more than four adults. Fortunately, the Hluhluwe Pack is beating the odds. It formed in 2000 when Jane, the only member of the original Hluhluwe Pack that had not died or dispersed, chose as her mate Don Juan, a dog introduced from Kruger National Park to add some fresh genes to the Hluhluwe-iMfolozi Park population. They successfully raised their first litter, six pups born in 2001, without any help from other related adults or offspring from previous years’ litters. Despite their advancing age—Jane is eight years old and Don Juan nine—this alpha pair has raised 22 pups to adulthood and is still going strong, raising seven pups in its fifth litter as this article goes to press.

Two pups from Jane and Don Juan’s first litter, Silver and his sister Perfect, were already full-grown adults and proficient hunters when I arrived in South Africa. Unlike lions, which violently kick out adolescent males from their pride, African wild dogs never force their offspring to leave their natal pack. But Silver and Perfect had no

opportunities to breed within their family group, so they struck out on their own.

Wild dogs leave their natal packs in small, same-sex groups at

adolescence and attempt to join groups of the opposite sex to form new packs. So I was not surprised when one day in September 2003, Silver and his two brothers left the Hluhluwe Pack, presumably in search of prospective mates. A few days later, Perfect and three of her sisters—two littermates and one younger sister from a 2002 litter—left the pack and were subsequently joined by three more of their sisters from the 2002 litter. Thus they were seven sisters travel-



When they are about three months old, pups begin to follow the pack on hunts.

Richard Du Toit/www.naturepl.com

ing together, and the group was called the Pleiades Sisters, after the famous seven sisters of Greek mythology.

With the help of my Zulu research assistant, Sboniso Blessing (Zama) Zwane, and a South African graduate student named Jan Graf, I tracked Silver’s group and the Pleiades Sisters throughout the next year, using signals from their radiocollars or reported sightings from local community members to keep up with them as they dispersed far and wide. In the first few months, the Pleiades Sisters stayed close to Jane and Don Juan’s pack, but Silver and his brothers left the confines of Hluhluwe-iMfolozi Park very quickly. His group traveled more than 60 miles north of the park, and was sighted all

over private game farms and reserves. One day, the manager of a private game farm welcomed us onto his property to look for Silver’s crew. When we caught up with Silver and one of his brothers, we found them running out of a thicket with a huge African bull elephant in hot pursuit.

Luckily for them, there were no lions on the property, but this bull elephant was much larger than a lion and so hot-tempered that the brothers beat a hasty retreat.

Over time, Silver’s two brothers disappeared (we suspect that they died) and only Silver remained. We later found him on a reserve in the uMkhuze section of the Greater St. Lucia Wetland Park, a World

All pack members, including yearlings, help care for the alpha pair’s offspring.

Heritage Site about 50 miles from his natal pack's territory, with a pair of dogs that were not his brothers. Much to our amazement, his companions were Perfect and his other sister Snow, wild dogs we hadn't seen since they left Hluhluwe-iMfolozi Park as part of the Pleiades Sisters more than six months earlier. The younger Pleiades Sisters were spotted in a provincial game reserve about 50 miles from Hluhluwe-iMfolozi's southwestern border. After a year of searching for mates, Silver, Perfect, and their siblings could not find any other wild dogs that were also dispersing from their natal packs.

Changing attitudes and increasing cooperation are already enabling wild dogs to naturally recolonize areas from which they have long been absent.

The National Zoo's Role in Wild Dog Conservation

As coordinator of the National Zoo's African Wild Dog Reintroduction and Conservation Program, I work with South African and American colleagues, including Steven Monfort and David Wildt from the Department of Reproductive Sciences at the Zoo's Conservation and Research Center, to study the behavior and physiology of African wild dogs. The data we collect help us maintain existing wild dog packs and improve reintroduction methods so that we can

ultimately establish a large, self-sustaining population of wild dogs in KwaZulu-Natal.

Much of our data come from an unlikely source—wild dog scat. National Zoo scientists pioneered a technique to extract and analyze

hormones from the fecal samples of many wildlife species. It's a particularly interesting and appropriate technique for studying stress in free-ranging African wild dogs. Collecting fecal samples from individual dogs is relatively easy and noninvasive, and the dogs' stress hormones tell us a great deal about their overall health and coping abilities.

Excessive stress can increase wild dogs' vulnerability to disease and reduce their reproductive success. Fecal hormone analysis enables us to measure the dogs' stress levels before and after major events such as reintroduction, dispersal from a natal pack, or translocation of individual dogs to new sites. It also helps us understand how ecological factors such as competition with larger predators or human activities such as farming and development affect the dogs physiologically.

To date, my research team and I have collected more than 400

samples from 40 individuals in Hluhluwe-iMfolozi Park, and are currently in the process of analyzing those samples for stress and reproductive hormones. In 2005, we added three new sites to our study—the Venetia Limpopo Nature Reserve, the Marakele National Park, and the uMkhuze section of the Greater St. Lucia Wetland Park—where my collaborators, assistants, and I have already collected more than 100 fecal samples at each site from dozens of known individuals. Preliminary data suggest that there are differences in stress levels between dominant individuals and their offspring during the breeding and nonbreeding seasons.

The next step in KwaZulu-Natal involves expanding populations of wild dogs to additional protected areas, reintroducing new packs onto provincial and privately owned reserves, and ensuring safe passage for dispersing dogs, like Silver and



A pack of African wild dogs, which formed recently when brothers from the Hluhluwe Pack joined sisters from the iMfolozi Pack, rests but keeps a close eye on a nearby impala.



Frans Lanting/www.lanting.com

Seeking relief from the blistering heat of the day, an African wild dog stands chest-deep in water.

Perfect, that move between protected areas. I am proud to say that our conservation and research program is already working toward this goal. In December 2004, we participated in the reintroduction of 13 wild dogs—five from the Madikwe Game Reserve in northwestern South Africa and eight from the Marakele National Park in northeastern South Africa—to the uMkhuze section of the Greater St. Lucia Wetland Park. For their first five months in uMkhuze, the dogs lived in a holding enclosure so they could form a stable pack before they were released. During that time, one of our program's South African research assistants, Janet Edwards, observed the dogs' behavior from the beginnings of their social bonding up until they were released in May 2005. Dubbed the Mkhuze Pack, this group produced its first litter of pups in September 2005. We hope that dispersing members of the Mkhuze Pack will one day join dispersing members of packs originating from Hluhluwe-iMfolozi Park to create new packs that will inhabit additional protected areas in KwaZulu-Natal. It has been very rewarding for me to be part of this African wild dog reintroduction and expansion conservation program.

As we conduct behavioral and physiological research, we are also helping to build scientific capacity in South Africa through the direct involvement of local graduate and undergraduate students, as well as local Zulu research assistants. What's more, we have initiated education and outreach programs to teach local community members,

farmers, and tourists that African wild dogs are endangered and need our protection, and that they are not vicious livestock killers but instead are skilled hunters that select weak prey and keep resident game populations healthy. Changing attitudes and increasing cooperation between conservation scientists, private landowners, and wildlife managers are already enabling wild dogs to naturally recolonize areas from which they have long been absent.

I thoroughly enjoy working with these captivating animals, and believe I'm making a real difference. The more we understand African wild dogs' behavior, physiology, and ecology, the better our reintroduction and conservation programs will be, not just for African wild dogs, but for endangered carnivores in general. In fact, African wild dogs serve as ambassadors for a far greater effort—the large-scale conservation of Africa's land and animals, so that many species will survive in an increasingly threatened landscape. Z

—Micaela Szykman is a research associate at the National Zoo's Conservation and Research Center, and coordinator of the African Wild Dog Reintroduction and Conservation Program. To support this project, please email szykmanm@si.edu.

Report from
the Field:

BY PETER MARRA

Terror in the Tropics



Colin Studds

A scientist from the National Zoo's Smithsonian Migratory Bird Center holds a juvenile American redstart.

My flight from Washington, D.C., to Montego Bay, Jamaica, seemed to take mere moments compared with my glacial procession through immigration and customs when I arrived at the MoBay Airport. I was nearing my 25th trip to the island of dreadlocks, Bob Marley, and glorious birds. Some things had changed since my first trip in 1989—traffic lights, SUVs, and cell phones were everywhere. Others, such as really bad roads and the omnipresent reggae soundtrack,

remained constants. I've spent time all over the island. I've trekked among the cycad ferns and stunted trees that cover the very tops of the Blue Mountains at about 7,000 feet, and sloshed waist-deep through mangrove swamps on the golden shores of the Caribbean Sea. No matter where I've been on the island—city or forest, airport or tourist-strewn beach—the Jamaican terrain can be challenging and difficult to navigate, but the birds made the effort worthwhile.

As with all my previous Jamaican trips, I came to study the wintering biology of warblers, including black-throated blue warblers (*Dendroica caerulescens*), ovenbirds (*Seiurus aurocapilla*), and, the focus of this trip in particular, American redstarts (*Setophaga ruticilla*). Redstarts—dazzling black and orange males and more subdued but still colorful females that sport green, gray, and yellow feathers—are familiar North American breeding birds. Like many migratory species, they spend most of the year, up to eight months, on their tropical wintering grounds. They migrate north in late April and early May to their U.S. and Canadian breeding grounds, then return south in the late summer. However, we know much more about redstarts' ecology and behavior during their three-month interlude in North America than what they do during their long stays in the tropics. My colleagues and I are working to change that.

I was joined on this expedition by Scott Sillett, a fellow member of the Smithsonian Migratory Bird Center (SMBC) at the National Zoo, two doctoral students, Colin Studds of the University of Maryland and Matt Reudink of Queen's University in Ontario, and two SMBC technicians, Bob Reitsma and Bill DeLuca. All are veterans of Jamaican field trips and are familiar with the pleasures and perils of studying the island's birds. So, after escaping the immigration bottleneck, we grabbed our bags, hopped in our eight-passenger van, and headed for the south coast, where one of the only long-term field studies on the wintering biology of Neotropical migratory birds was entering its 20th year.

An hour and a half later, we arrived at the Culloden Cove Villa in Whitehouse, Westmoreland Parish, our home for the next two weeks. After opening a few cold Red Stripes, we lounged in the warm tropical air and talked about the next day's work. Our objectives were simple enough, the work difficult but routine for veterans like us. But that first day turned out to be anything but routine. In fact, it was horrific.

But First, Some Background

On this trip our goals were to count the redstarts sighted on our study sites, capture and color-band birds for future identification, and census returning redstarts that had been color-banded in previous years. Some of the individuals we banded in previous years have come back year after year, often to the same tree. Three individuals, two males and one female, have made nine round trips during which they've managed to avoid becoming meals for predatory hawks, and to steer clear of fatal collisions with buildings and radio towers. Unfortunately, we still don't know where in North America the redstarts that winter in Jamaica breed. They may all go back to a single breeding site or may disperse across the continent. This puzzle is one we are working hard to solve.

On Jamaica's south coast, we work in the Font Hill Nature Preserve, mostly in two habitat types: black mangrove forest and second-growth logwood scrub. The mangrove forest sites are essentially pristine, with many trees more than three feet in diameter and 65 feet tall. At least that was the case until September 2004, when Hurricane Ivan leveled many of these mammoths in one fell swoop. Now these sites are mangrove graveyards, with just a few lone mangroves stretching high into the sky. Once we birded there with ease but now walking even five

feet through this habitat is a formidable task.

Our scrub sites have always been essentially impenetrable. We have cut and maintained an elaborate system of trails over the years so we can sneak around without making too much noise and without shredding our clothes and skin on the many spiny and thorny plants there. Despite the challenges they pose, these sites are dripping with migratory birds, and our work on redstarts and other species reveals much about what makes migratory birds tick in the tropics.

For example, many migratory species aggressively defend their winter territories. Who would have thought that these fluffy little summer songsters are actually nasty, feather-pulling adversaries?

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Matthew Reudink

While wading in mangroves to find redstarts, Zoo scientists hope to avoid branches, quicksand-like mud, and other dangers submerged in the water.



American redstarts spend most of the year in Jamaica and other tropical regions, but breed in the U.S. and Canada. Adult males, like the one pictured here, sometimes mate with two females that raise broods in separate nests.

Sometimes I capture birds by putting a stuffed redstart decoy at the base of an almost invisible net and then turn on a recording of the species' song. It often takes less than a minute for a territory owner to swoop down on the decoy and start ripping out its back feathers. Individuals have good reason for defending their territories with such gusto. Food for these birds, arthropods such as various insects and spiders, is plentiful in October and November, but by March and April, famine sets in.

Some areas are better than others, however. Individuals with territories in the best areas—those with the greatest abundance of food during the famine—have the best chance of surviving through the grueling winter, enduring the long spring migration back to breeding areas, and producing young during the summer. In fact, one of our most important and exciting discoveries is that the reproductive success of redstarts in the U.S. and Canada is determined not by local events, but rather by the quality of their winter habitats. Findings like this emphasize the importance of studying migratory birds during the winter portion of their annual cycle.

Unfortunately, our study of migratory birds on tropical wintering grounds remains one of perhaps only two or three similar projects. Funding such research, despite its importance to understanding and

conserving migratory birds, remains a difficult and sometimes impossible undertaking.

A Good Day Turns Horribly Bad

We awoke at 5 a.m. to the dawn chorus of loggerhead kingbirds (*Tyrannus caudifasciatus*) and fortified ourselves for the first day of field work with strong cowboy coffee and ginger bullas—heavy cakelike bread made with pungent Jamaican ginger. By 6 a.m. I was on one of my logwood scrub plots watching a Swainson's warbler (*Limnothlypis swainsonii*), a migrant from the southeastern U.S., flip leaves in search of ground-living arthropods. Within ten minutes, members of four other warbler species greeted me with chips. Over the years, we have identified more than 30 species of warblers at these sites, many of which are abundant.

Soon I heard the characteristic high-pitched chip of a redstart and made my way to see if it was one we captured and banded on a previous trip. On their breeding grounds, redstarts and other warblers sing elaborate songs to attract mates and defend their territories. On their wintering grounds, they vocalize only with chips. Like its song, each species has its own unique-sounding chip, so we can identify a bird without even laying eyes upon its colorful little body. In this case,

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Smithsonian Birders to Play in the World Series

by Russell Greenberg

The World Series of Birding, that is. On May 13, 2006, a team of ornithologists from the Smithsonian Institution, armed with their vast knowledge of birds, will compete for the highly vaunted Urner-Stone Cup. It is the birding world's equivalent of baseball's World Series Trophy or football's Lombardi Cup, and to win it, the team will have to record more bird species within the state of New Jersey than any other team, in just one day. Despite strong competition from teams representing other birding powerhouses in the U.S., including the Cornell Lab of Ornithology and the New Jersey Audubon Society, members of the Smithsonian Ornithology team are heading up to the Garden State with victory on their minds.

This is more than mere sport, and the goal isn't winning fat contract offers next season for the team's star players. Apart from the thrill of victory, winning isn't about personal gain. Rather, it's about raising much-needed funds to support the mission of Smithsonian ornithologists: to train the next generation of scientists to study and protect birds throughout the world.

Like any great sporting event, the World Series of Birding attracts media, corporate sponsors, and product endorsements, in this case for the latest in binoculars, scopes, field guides, and birding paraphernalia. But at this event, the hype is for the greater good. The World Series of Birding is a great opportunity to focus public attention on environmental issues affecting local and national birds. Furthermore, over the last 20 years, this event has raised millions of dollars for the conservation of birds and their habitats.

"Big Days"—when birders gather to list as many species as possible in a particular location—are traditions that occur around the globe. But the World Series of Birding, now in its 22nd year, is *the* Big Day. This is when and where birders really show their stuff.

The Big Day begins at midnight and teams bird nonstop for the next 24 hours. When they reach the finish line at Cape May at 11:59 p.m., bird lists are reviewed and champions are made. The actual day is exhausting, but it is merely the culmination of an arduous "spring training": months of organization and team selection, weeks of diligent scouting, and days of painstaking planning to develop the perfect route to accumulate the more than 200 species of birds that are recorded by the top teams.

Within the World Series event are several different types of competitions. Some teams opt, for instance, to rack up lists at individual sites or in particular counties. But the crown jewel of the World Series is the grueling statewide contest, and the Smithsonian team has its eyes on that prize. A typical day begins in the dark of night at the northern end of the state, where our ears will be trained to detect the calls of nocturnal owls such as saw-whet owls (*Aegolius acadicus*), secretive marsh birds such as American bitterns (*Botaurus lentiginosus*), and, our heads craned skyward, the faint calls of night-flying migrants such as gray-cheeked thrushes (*Catharus minimus*). Birding then proceeds nonstop over hundreds of miles, with team members searching for and ticking off birds both common and rare on the road to Cape May.

The Smithsonian team is diligently preparing for the competition, hoping for big rewards, and looking for fans to support their efforts. Most teams have a corporate spon-

Saw-whet owl.

Robert Royce



sor; the Smithsonian team's generous sponsor is Bushnell, maker of binoculars, spotting scopes, and other optics. Teams also generate additional pledges from their fan base—and this is how FONZ members and others can help. Fans typically pledge a certain amount for each bird species the team records, and the contributions go toward a conservation effort of the team's choosing. In this case, all funds raised will help Smithsonian ornithologists research birds around the world, to help ensure that birds are there for future Big Days and for our kids and grandkids.

To make a pledge or contribute in other ways to the Smithsonian Ornithology team's quest to win the World Series, please visit <http://sio.si.edu>. There you will find out about the work we do to study and protect birds the other 364 days of the year.

—Russell Greenberg is an ornithologist at the Smithsonian's National Zoo and a member of the Smithsonian Ornithology team that will compete at the 2006 World Series of Birding.

I followed the chips to a returning female redstart with bright blue, red, and aluminum bands. The bird was a two-year-old female and she was back on the same territory she had occupied the previous year.

Our team had a highly productive morning. By 11 a.m., we had located a dozen or so returning redstarts and another three dozen unbanded birds. But we decided to do one last pass through parts of the mangroves before breaking for lunch.

To find birds in mangrove habitat, we have to wade through sometimes waist-deep water while staring up into the crowns of trees. This is more challenging than it sounds because underwater obstacles such as submerged branches, quicksand-like mud, and the occasional

I was listening intently for redstart chips among the cacophony of the forest when suddenly a new and heart-stopping sound pierced the air. I heard Colin scream—a loud, deep, scared guttural scream—then heard a big splash. As Colin yelled for help, I thought: crocodile! In all our years in Jamaica, crocodiles in the mangroves have gone their way and we have gone ours. Unlike their African and Australian cousins, these crocs, we thought, aren't man-eaters. Still, somehow I knew at once exactly what had happened. While scanning the crowns of the mangroves, Colin surprised a six-foot-long underwater obstacle with a lot of very sharp teeth. The croc bit his leg twice and spun his sturdy frame to the ground as though

I heard Colin scream—a loud, deep, scared guttural scream—then heard a big splash. As Colin yelled for help, I thought: crocodile!

he were a pick-up stick. Two things saved him: Colin braced himself on the base of a nearby mangrove tree and some land to keep the croc from dragging him away, and the croc seemed to lose interest, as if he'd decided he wasn't in the mood for a lunch of field researcher.

All members of the team quickly converged to rescue Colin, then rushed him back to the van and to the nearest hospital, where his large gaping wounds were cleaned out. He spent the rest of the week on the couch, popping antibiotics and recuperating mentally from his traumatic experience. Fortunately, Colin will fully recover from his injuries, with scars he can use as props for telling what we all hope is a once-in-a-lifetime story.

The rest of the team soldiered on with field work—but we spent as little time as possible in the mangroves. In the end, we located dozens of returning redstarts and put bands on another 50 or so birds. We returned to the National Zoo thankful that Colin was still in one piece and reflected on the importance of this research, despite its risks. We all hope to go back to Jamaica next year, just like the American redstarts and other migratory birds returning there from points north. I suspect we'll complain less about bad roads and incessant reggae, minor irritants compared to death by swamp croc. But the birds make it all worthwhile. Z



Kristine Sillett

An American crocodile displays a mouth full of menacing teeth.

crocodile (*Crocodylus acutus*) impede progress. But the water can also be refreshing when the temperature is nearing 100°F, so we forged ahead into the swamp, each of us taking a different direction. Colin was my closest companion, walking about 100 yards away.

—Peter Marra is an ornithologist with the Smithsonian Migratory Bird Center at the National Zoo.

The Weather Makers: How Man Is Changing the Climate and What It Means for Life on Earth

Tim Flannery. 2006. Atlantic Monthly Press, New York. 352 pp., hardbound. \$25.

Scarcely a day goes by without one more article in the newspaper on some new twist in the climate-change story. I suspect that many people respond as I do: Skim the headline, turn the page, and look for some news. Everyone is aware of the threats posed by global warming, if only from the apocalyptic (and error-ridden) 2004 film *The Day After Tomorrow*. (Far fewer understand how and why the climate is changing—it's not easy.) But, except in the Hollywood version, can climate change really be the end of the world?

If you think not, as I did, read *The Weather Makers*. It's easy to dismiss the doomsday scenario of a film script, but the dire predictions of renowned scientist Tim Flannery are hard to discount. His reading of the evidence convinced him that unless the world gets serious about dramatically reducing its carbon footprint, starting today, we really could be looking at the end of civilization as we know it. Not the day after tomorrow, but almost certainly in the lifetimes of our grandchildren.

Flannery is the director of the South Australian Museum, a professor at the University of Adelaide, and one of Australia's leading thinkers. In addition to his specialized scientific writing, he contributes regularly to *The New York Review of Books*, and is the author of acclaimed books for the general public, including environmental histories of Australia (*The Future Eaters*) and North America (*The Eternal Frontier*), both of which I highly recommend.

A biologist and conservationist, Flannery admits he came to be interested in and concerned about the effects of climate change only recently—in 2001—believing there were more immediate threats, such as rampant habitat destruction, to the world's flora and fauna. Then he started reading that species are being driven to extinction right now by changing climate in the habitats left to them. This spurred him to delve into a scientific literature new to him so he could get to the bottom of what was going on. *The Weather Makers* is the result of his study, and a call to all of us to take action.

Apart from the reputation of its author, what's so persuasive about *The Weather Makers* is Flannery's inexorable piling on of facts—what is known with scientific certainty—coupled with careful explication of the scientific evidence that underpins predictions about the future. What's more, he offers his readers an excellent introduction to climatology, including the history of climate change and its impacts over the last 65 million years. Flannery makes this complex science accessible and offers explanations for the uncertainties that lead some to question whether human-induced climate change is a real problem and whether we really have to do anything at all. After reading this book, nonspecialists will truly understand what all the fuss is about, and how human activities, especially the use of fossil fuels, are responsible for modern climate change. As Flannery puts it, "We are now the weather makers..."

For at least a few species, it's already too late. The golden toad, a once-common (and uncommonly beautiful) species in the cloud forests of Costa Rica, went extinct when an abrupt rise in sea surface temperatures in the Pacific Ocean reduced the amount of mist in its habitat to the point that the toads simply dried out. Many other mountain-dwelling species are on a similar sort of reverse slippery slope. When circumstances change within a species' habitat—get hotter or colder, wetter or dryer—the animals and plants either adapt to the new conditions, migrate to find new suitable habitat, or go extinct as the golden toad has. Very rapidly changing conditions tend to preclude adaptation, and migration is only possible when there is somewhere to migrate to, which is particularly problematic when you live in an isolated or island habitat from which there is no exit, or within a narrow altitudinal climate belt on a mountain.

Our beloved giant pandas provide a simplified example. The bamboos that pandas depend on grow higher than about 6,600 feet above sea level, where it is cool and wet. As temperatures rise, so too will the bamboo belt, and the pandas will have to migrate with the bamboo. This is all well and good—until the bamboo and the pandas get to the top of the mountain and fall off.

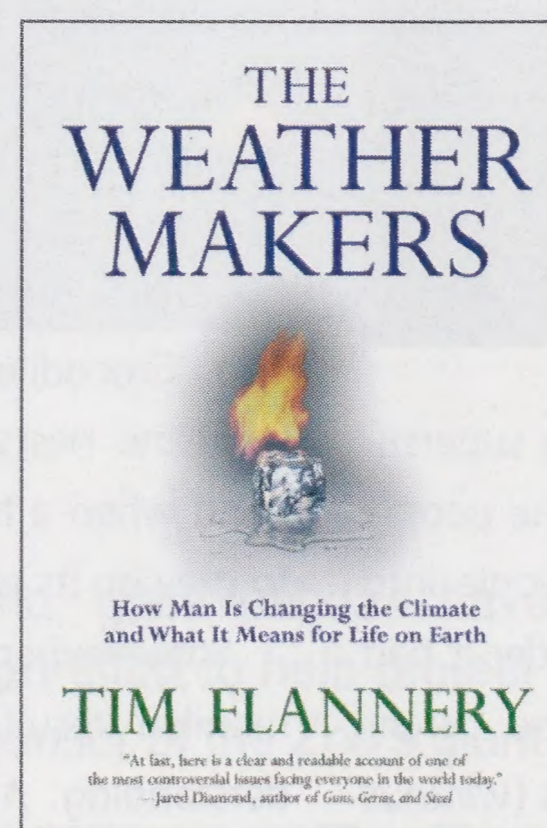
The human species isn't in danger of falling off the mountains or migrating lemming-like into the sea, although people who live in coastal areas may be inundated by rising sea levels that result from melting glaciers. But Flannery does paint a pretty gloomy picture of the quality of life our grandchildren can expect if we don't become responsible weather makers: enormous losses of biodiversity; food shortages as highly productive agricultural land changes in extent and distribution; increased conflict between the haves and the have-nots; and more and bigger floods, droughts, heat waves, and storms—think Hurricane Katrina many times over—leading to

huge economic losses. It is telling that the insurance industry is one of the most concerned about future climate change, predicting rising claims they cannot absorb.

Surprisingly, Flannery ends on a positive note. With enough political will, the governments of the world can stabilize the Earth's temperature before disaster becomes unavoidable. And Flannery recommends that individuals take their own action—simple things like

walking more and driving less, and using the most energy-efficient products possible—and harder ones, like using solar panels to heat your household water, which, Flannery reports, is eminently doable and affordable. Even with concerted effort, it will be too late for some species and some places, but many more will survive, and our grandchildren will thank us.

—Susan Lumpkin



BioAlmanac

by Jennifer Winger

Out of Africa

A swarm of African *Schistocerca* locusts may have used the dead bodies of their peers as floatation devices and food to survive a transatlantic migration to the New World more than three million years ago. Winds blowing westward likely also aided their incredible journey.

Scientists have long debated the origins of locusts in the *Schistocerca* genus. There are about 50 *Schistocerca* species in the New World and only one—the African desert locust (*S. gregaria*), an insect notorious for devastating crops—in the eastern hemisphere. Some scientists thought that the New World locusts flew east across the Atlantic and gave rise to *S. gregaria* in Africa, the Middle East, and western Asia. But a new study published in the January 2006 issue of the *Proceedings of the Royal Society B* uses DNA evidence to substantiate the opposite theory: *S. gregaria*'s African ancestors were the true originals, and they flew to South America and eventually radiated into diverse species. In 1988, a swarm of *S. gregaria* proved it was capable of such a journey when it flew from Africa to the Caribbean.



What's in a Name?



Monitor lizards are no strangers to superstition. In Thailand, for example, some people believe the full moon can turn people into vicious "weremonitors," and consider it bad luck to find a monitor inside a house. Larger monitors such as Komodo dragons (*Varanus komodoensis*) and water monitors (*V. salvator*), which eat carrion, are also thought to dig up human corpses and consume them, which doesn't help their reputation.

The word "monitor" derives from the Latin word *monere*, which means "to

warn." The lizards' common name may have been spawned by another superstition: that the Nile monitor (*V. niloticus*) keeps watch for crocodiles and warns people, by its presence, when a crocodile is nearby. But Nile monitors' propensity for being near crocodiles has more to do with their appetite for crocodile eggs than their power of prediction. Crocodiles rarely stray far from their shoreline nests, so one is usually close at hand when a Nile monitor leaves the water to prey on its eggs.

Some experts suggest that the monitor moniker resulted from a linguistic misunderstanding. Arabs called the Nile monitor *ouaran* or *varan*, the root of the monitors' family name, Varanidae. In German, these Arabic words were confused with the word *warnen*, which means "to warn," and the lizards were dubbed *Warn-eidechsen*, which means "monitor lizard."

How Does an Opossum Play Dead?

Virginia opossums (*Didelphis virginiana*) sometimes fake their own deaths to stay alive. An opossum threatened by a predator such as a coyote or a fox may drop to the ground and enter a catatonic state that lasts between 30 seconds and six hours. During that time, the opossum's body is rigid and insensitive to touch, its breathing is shallow, and its mouth usually falls open. The ruse may confuse predators or deter those that eat only live prey. "Playing opossum" is a highly effective defense mechanism but these animals also use more common tricks to scare away attackers, such as baring their teeth or hissing and growling.

Fact or Fiction: Crocodile Tears

According to ancient folklore, crocodiles (*Crocodylus* spp.) weep loudly to lure humans within striking distance, then devour them while crying piteously. The first known written account of this fictional phenomenon dates back to a 13th-century French encyclopedia, and was perpetuated in subsequent works, including Shakespeare's *Othello*. Today, "crocodile tears" are an expression of insincere remorse. Crocodiles don't actually cry, but they do produce secretions that look like tears. Lachrymal glands lubricate their eyes with a protein-fortified fluid, and a nictitating membrane, which acts as a third eyelid, flushes out bacteria so the reptiles can see while submerged.

In Season

Spring may come in like a lion, but in the mid-Atlantic, it is announced by a little frog's whistle rather than a mighty lion's roar. In evenings or on cloudy days from early March through June, male northern spring peepers (*Pseudacris crucifer*) perch on vegetation near ponds or marshes and serenade potential mates. They inflate their vocal sacs, which look like bubblegum bubbles, and then release the air inside to make short, shrill notes—or peeps—at regular intervals of about one per second. Often, a trio of males will peep in quick succession, and when many males congregate their chorus sounds like very loud sleigh bells. Males that sing faster and louder than their competitors distinguish themselves from the crowd and are more attractive to females.



Seahorses (family Syngnathidae) are probably the slowest-swimming fish in the world. According to Guinness World Records, some smaller seahorses' top swimming speed is 0.001 miles per hour.

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Fujifilm's support helped the National Zoo bring giant pandas Mei Xiang and Tian Tian to Washington, and is assisting the Zoo's experts to develop the scientific knowledge they need to ensure the survival of pandas in the wild. Fujifilm also supports comprehensive conservation education programs designed to help children and adults learn more about giant pandas and the conservation of all wildlife and their habitats.

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Get the Picture

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Only one thing could make an evening of sampling gourmet fare from Washington's finest restaurants even better. A giant panda cub! Join Tai Shan (affectionately known as Butterstick) on May 18, 2006, at the Smithsonian's National Zoo for an unforgettable night of food and fun. Tickets are on sale now at www.fonz.org/zoofari.htm.

National ZooFari 2006: Black & White Night



Friends of the National Zoo, 3001 Connecticut Avenue, NW, Washington, DC 20008, www.fonz.org